AD-A049 388 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO F/G 9/1
PULSED X-RAY TUBE,(U)
SEP 77 N I KOMYAK, N A DRON', Y A PELIKS
UNCLASSIFIED FTD-ID(RS)T-1533-77 NL

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FTD-ID(RS)T-1533-77

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PULSED X-RAY TUBE

by

N. I. Komyak, N. A. Dron',
et al.

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EDITED TRANSLATION

FTD-ID(RS)T-1533-77 14 September 1977

MICROFICHE NR: FTD-77-C-001169

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By: N. I. Komyak, N. A. Dron', et al.

English pages: 5

Source: USSR Patent No. 273345, 15 June 1970, PP. 1-2

Country of origin: USSR
Translated by: Marilyn Olaechea
Requester: FTD/ETDP
Approved for public release; distribution unlimited

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

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А а	*А а*	A, a	Р р	*Р р*	R, r
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В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere. When written as ë in Russian, transliterate as yë or ë. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

GREEK ALPHABET

Alpha	A	α		Nu	N	ν	
Beta	B	β		Xi	Ξ	ξ	
Gamma	Γ	γ		Omicron	O	o	
Delta	Δ	δ		Pi	Π	π	
Epsilon	E	ε		Rho	P	ρ	
Zeta	Z	ζ		Sigma	Σ	σ	ς
Eta	H	η		Tau	T	τ	
Theta	Θ	θ		Upsilon	T	υ	
Iota	I	ι		Phi	Φ	φ	ϕ
Kappa	K	κ		Chi	X	χ	
Lambda	Λ	λ		Psi	Ψ	ψ	
Mu	M	μ		Omega	Ω	ω	

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English
sin	sin
cos	cos
tg	tan
ctg	cot
sec	sec
cosec	csc
sh	sinh
ch	cosh
th	tanh
cth	coth
sch	sech
csch	csch
arc sin	$\sin^{-1}$
arc cos	$\cos^{-1}$
arc tg	$\tan^{-1}$
arc ctg	$\cot^{-1}$
arc sec	$\sec^{-1}$
arc cosec	$\csc^{-1}$
arc sh	$\sinh^{-1}$
arc ch	$\cosh^{-1}$
arc th	$\tanh^{-1}$
arc cth	$\coth^{-1}$
arc sch	sech^{-1}
arc csch	csch^{-1}
rot	curl
lg	log

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PULSED X-RAY TUBE

N. I. Komyak, N. A. Dron', Ye. A. Peliks, V. M. Kurbatov, Ye. I. Bichenkov, R. L. Rabinovich, V. V. Polyudov, and V. M. Titov

This is an invention in the field of pulsed X-ray tubes, specifically, pulsed X-ray tubes with a cold cathode.

We are familiar with pulsed X-ray tubes with a cold cathode, designed for work with a high voltage transformer source with an anode in the form of a metal rod, sharpened on the end, and a cathode in the form of a metal cylinder. Their main defect is their relatively short service life, related to destruction of the anode during the plasma discharges which occur in the tube (dulling of the

anode needle).

Moreover, the radiation intensity of such tubes is primarily the result of the electron current during the initial stage of the breakdown in the anode-cathode gap and the voltage at which this breakdown occurs. We know that breakdown voltage depends primarily on the transconductance of the leading front of high voltage pulse applied to the tube anode and has a very weak dependence on the distance between the anode and the cathode.

When such tubes are fed from high-voltage transformer sources the transconductance of the pulse front is limited to the inductance of the windings. Thus, it is difficult to create a tube with a breakdown voltage of above 10^6 V. Increasing the breakdown gap in the tube leads to a sharp increase in its dimensions with only a slight increase in the breakdown voltage.

The object of the invention was to create a pulsed X-ray tube with a greater service life and greater breakdown voltage in the discharge gap (above 10^6 V).

For this purpose the anode of the tube was made in the form of a bimetallic rod, sharpened on the end. Its core was made of a high-melting metal with a high atomic number, its shell - from a less

refractory metal with a lower atomic number. In addition the discharge gap of the tube contains two metallic insulators separating electrodes coaxial to the anode and to each other, which do not having outlets. One of these is near the anode, the other near the cathode.

The figure shows a schematic cutaway of one variation of the invention.

The tube consists of cathode cylinder 1, glass bulb 2, bimetallic anode 3. Core 4 of the anode is made of tungsten, shell 5 - from titanium.

Insulated electrode 6 consists of a metal cylinder, secured by insulator 7 around the anode. Insulated electrode 8 consists of a hollow metallic truncated cone, which is secured by means of insulator 9 to the cathode cylinder. Sylphons 10 an 11 make it possible to regulate the position of the electrodes during adjustment of the tube.

When the tube is in operation, insulated electrodes 6 and 8, together with anode 3 and cathode 1, form three series-connected capacitances in the discharge gap of the tube. Because of this the pulse voltage of the transformer which supplies the tube is

distributed by capacitances, and the breakdown voltage on the sharp edges of the electrodes is reached at a higher voltage. Also, by regulating the mutual position of electrodes 6 and 8 relative to the anode and cathode the electron current can be focused on the anode point. In vacuum discharges in the tube shell 5 of the anode is destroyed faster than its core 4. As a result we observe the phenomenon of self-sharping of the anode during the working process of the tube, which significantly increases its service life, reduces the diameter of the focus spot, and stabilizes its position.

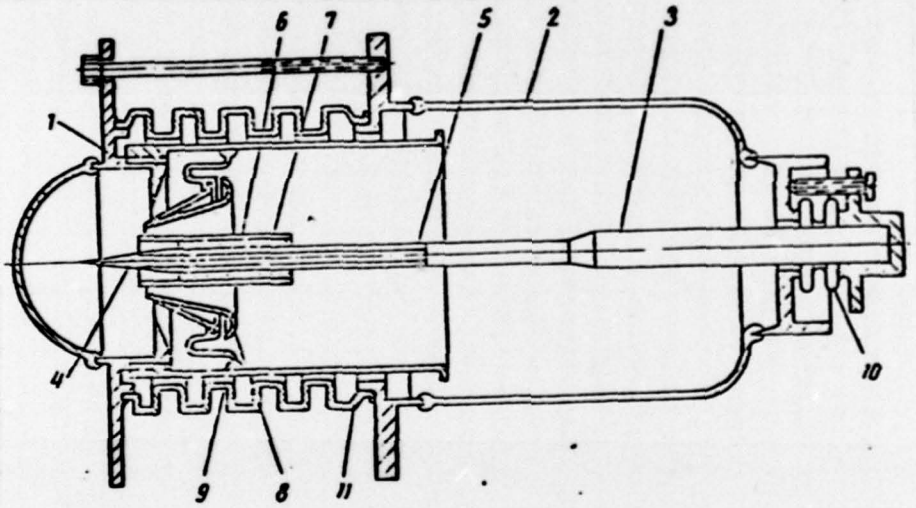
In testing mock-ups of the tube it was established that the breakdown voltage of the tube was 1500-1800 kV while service life exceeded 5000 switchings.

Objecks of the Invention

1. The pulsed X-ray tube contains a sharpened anode and a cold cathode, arranged coaxially. It is distinguished by the fact that in order to increase service life and stabilize the diameter of the focus spot, the anode of the tube is made in the form of a bimetalic coaxial rod, while its core is made of a high-melting metal with a high atomic number. The shell is made of a less refractory metal with a lower atomic number.

2. According to Section 1 the tube is distinguished by the fact that in order to increase breakdown voltage of the anode-cathode gap, the discharge gap of the tube contains two metal electrodes, which are coaxial to the anode and to each other, are insulated from each other, and have no lead-outs from the tube.

Figure.



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER FTD-ID(RS)T-1533-77	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) PULSED X-RAY TUBE		5. TYPE OF REPORT & PERIOD COVERED Translation 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) N. I. Komyak, N. A. Dron', et al.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Foreign Technology Division Air Force Systems Command U. S. Air Force		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE 15 June 1970 13. NUMBER OF PAGES 5
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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